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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Certificate

JUL 26 2005

of Correction

In re Patent of

Fax: 571-273-8300

LANG et al.

Patent No. 6,901,873

Patent Date: June 7, 2005

For: LOW-DRAG HYDRODYNAMIC SURFACES

REQUEST FOR CERTIFICATE OF CORRECTION

To the Director of the Patent and Trademark Office

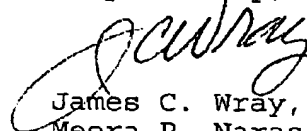
Sir:

Kindly accept and enter the attached Certificate of
Correction for the above-identified patent.

Also attached is a marked-up copy of the title page of the
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the correct address of the second inventor.

Since the error originated in the Patent and Trademark
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Respectfully,



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PTO/SB/44 (04-04)
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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,901,873
DATED : June 7, 2005
INVENTOR(S) : Thomas G. Lang and James T. Lang

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title Page

Item (76), line 3.

The street address of the second inventor should read:

559 Homer Avenue

MAILING ADDRESS OF SENDER:

James C. Wray
1493 Chain Bridge Road, Suite 300
McLean, VA 22101

PATENT NO. 6,901,872

No. of additional copies

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete. Including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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PAGE 2/5 * RCVD AT 7/12/2005 1:29:35 PM [Eastern Daylight Time] * SVR:USPTO-EFXXRF-1/4 * DNIS:8729306 * CSID:703 448 7397 * DURATION (mm-ss):02-16

PAGE 2/5 * RCVD AT 7/22/2005 10:57:57 AM [Eastern Daylight Time] * SVR:USPTO-EFXXRF-8/25 * DNIS:2738300 * CSID:703 448 7397 * DURATION (mm-ss):02-28

JUL 28 2005



US 6,901,873 B1

(12) **United States Patent**
Lang et al.

(10) Patent No.: **US 6,901,873 B1**
(45) Date of Patent: **Jun. 7, 2005**

(54) **LOW-DRAG HYDRODYNAMIC SURFACES**

(76) Inventors: Thomas G. Lang, 417 Loma Large Dr.,
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CA (US) 94301

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: 09/852,616

(22) Filed: May 11, 2001

Related U.S. Application Data

(60) Continuation-in-part of application No. 09/689,698,
filed on Oct. 13, 2000, now Pat. No. 6,439,148, which
is a division of application No. 08/948,242, filed on
Oct. 9, 1997, now Pat. No. 6,167,829.

(51) Int. Cl. B63B 1/38; B63B 1/28
(52) U.S. Cl. 114/67 A; 114/61.1; 114/278;
114/280; 114/289

(58) Field of Search 114/67 A, 277,
114/278, 61.1, 61.12, 271-275, 280-282,
114/288-290; 244/204, 207-212

(56) **References Cited**

U.S. PATENT DOCUMENTS

986,766 A * 3/1911 Schroeder 440/44
1,003,364 A * 9/1911 Langston 114/290
1,030,517 A * 1/1913 Chase
1,121,006 A 12/1914 Fieber
1,389,865 A * 9/1921 Fox 114/67 A
1,621,625 A * 3/1927 Casey
3,044,432 A 7/1962 Wennagel
3,109,495 A 11/1963 Lang
3,199,484 A 8/1965 Wiberg
3,203,389 A 8/1965 Calc

3,467,043 A 9/1969 Bowles
(Continued)

FOREIGN PATENT DOCUMENTS

JP 61081283 A * 4/1986 B63B 1/38
(Continued)

OTHER PUBLICATIONS

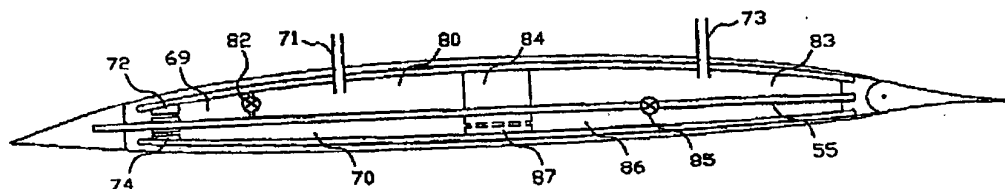
(No named author); *State-of-the-Art Investigation on Artificial Cavity Ships*; Project Report, Ship Hydrodynamic Division, Krylov Shipbuilding Research Institute; St. Petersburg, Russia, Feb. 2001; 70 pages.

Primary Examiner—S. Joseph Morano
Assistant Examiner—Ajay Vasudeva
(74) Attorney, Agent, or Firm—James Creighton Wray;
Mecra P. Narasimhan

(57) **ABSTRACT**

The invention relates to the use of gas cavities to reduce frictional drag on underwater surfaces such as hydrofoils, struts, fins, rudders, keels, propeller blades, ship hulls, underwater bodies, and wetted surfaces in general. Each gas-filled cavity is formed behind a discontinuity in the surface that causes the water boundary layer to separate from the surface. Gas is ejected into a region behind the discontinuity to fill the cavity; the gas can be air. If a cavity is open to the atmosphere, then air can typically fill the cavity naturally without air ejection. Cavities can either be closed or open. A low drag hydrofoil may have a closed cavity on one side, and an open cavity on the other side. For closed cavities, the underlying surface can be shaped to minimize cavity closure drag. Various ways to generate cavities, change hydrodynamic forces, and duct gas internally on hydrofoils and struts with cavities are covered. Different designs of hydrofoil boats, hydrofoil ships and ship hulls that are amenable to drag reduction are presented.

223 Claims, 12 Drawing Sheets



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**DECLARATION FOR UTILITY OR
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(37 CFR 1.63)**

☒ Declaration
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with Initial
Filing

OR

☐ Declaration
Submitted after Initial
Filing (surcharge
(37 CFR 1.16 (e))
required)

Attorney Docket Number

First Named Inventor

LANG

COMPLETE IF KNOWN

Application Number

Filing Date

05/11/2001

Group Art Unit

Examiner Name

As a below named inventor, I hereby declare that:

My residence, mailing address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Low-Drag Hydrodynamic Surfaces

(Title of the Invention)

the specification of which

☒ is attached hereto

OR

☐ was filed on (MM/DD/YYYY)

as United States Application Number or PCT International

Application Number

and was amended on (MM/DD/YYYY)

(if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT International filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 385(b) of any foreign application(s) for patent or inventor's certificate, or 385(a) of any PCT International application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or any PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
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☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)

☐ Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

[Page 1 of 2]

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NAME OF SOLE OR FIRST INVENTOR:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name Thomas C.		Family Name Lang	
(first and middle (if any))		or Surname	
Inventor's Signature <i>Thomas C. Lang</i>		Date 5/10/01	
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Mailing Address 417 Loma Larga Drive			
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City Solana Beach	State CA	ZIP 92075	Country US
NAME OF SECOND INVENTOR:		<input type="checkbox"/> A petition has been filed for this unsigned inventor	
Given Name James T.		Family Name Lang	
(first and middle (if any))		or Surname	
Inventor's Signature <i>James T. Lang</i>		Date 5/10/01	
Residence City Palo Alto	State CA	Country US	Citizenship US
Mailing Address 599 Homer Avenue			
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